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OCCUPATIONAL STRUCTURE IN THE  
MILITARY AND CIVILIAN SECTORS  
OF THE ECONOMY

by

Sheldon E. Haber

*Serial TR-1224.*

THE GEORGE WASHINGTON UNIVERSITY  
Graduate School of Arts and Sciences



This report was prepared under the  
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Sheldon E. Haber<sup>†</sup>

The need for a useful and manageable classification of occupations for military manpower management is generally recognized. This need has been heightened in recent years as military technology has advanced increasing the competition between the military and civilian sectors for skilled manpower. The advent of an all-volunteer military establishment further crystalizes the need for occupational analysis wherein the two sectors are viewed as a whole and treated in an integrated manner.

Although there are a number of systems for grouping occupations in the civilian and military sectors, the criteria employed in each system are different. The most important system in the civilian sector is that developed by the Bureau of the Census. In the military sector, the Department of Defense (DOD) has established a classification scheme which ties together the systems utilized by the individual military services. The major objectives of this paper are, first, to bring

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together data from these two sources in order to compare the occupational structure of the civilian and military work force and, second, to examine the implications of this structure for manpower policies aimed at implementing the all-volunteer force concept.

Although the military comprises only a small proportion of all workers, a substantial percentage of workers in the craftsmen and related occupations are in the armed forces. Additionally, these occupations are among the most rapidly growing ones in the civilian sector. These findings suggest that policies directed toward enlarging the supply of manpower to the military by increasing retention rates, lateral transfer from the civilian to the military sector, and utilization of women may be constrained by the technology of production in the military sector and the supply of skilled manpower in the civilian sector. These constraints are more severe for the Navy than for the other services since a much larger proportion of the Navy's work force is comprised of craftsmen and related workers than the military as a whole.

#### Trends in the Occupational Structure of the Civilian and Military Work Force

One of the more significant changes in the structure of the economy over many decades has been the decline in the proportion of the work force performing manual tasks. Similarly, in the military sector, the proportion of personnel attached to ground combat and general duty military occupations has also declined. At the end of World War I, for example, 40 percent of the military work force was estimated to be in this category. [16, p. 52] By the end of World War II, the corresponding figure was approximately 24 percent. This may be compared with the percentage of the civilian work force classified as operatives and laborers (including those in farming) which stood at 35 percent in 1940. Changes in the occupational distribution of the civilian and military sectors since 1940 are shown in Tables 1 and 2. In each table, occupations are aggregated into major groupings based on the Census and DOD



Table 1

OCCUPATIONAL DISTRIBUTION OF  
EMPLOYED MALES, 1940-1970

<u>Occupation Group</u>	<u>Percent Distribution</u>			
	<u>1940</u>	<u>1950</u>	<u>1960</u>	<u>1970</u>
Professional, technical, and kindred workers	6.1	7.3	9.9	13.5
Managers and administrators, except farm	9.6	10.7	11.0	10.6
Farmers and farm managers	14.8	10.3	5.5	2.7
Clerical and kindred workers	6.0	6.4	6.7	7.2
Sales workers	6.7	6.4	6.9	6.8
Craftsmen, foremen, and kindred workers	14.9	18.6	19.9	19.7
Operatives and kindred workers	17.9	20.0	18.8	18.2
Laborers, except farm	8.9	8.2	7.2	6.1
Farm laborers and farm foremen	8.2	4.9	2.8	1.6
Service and private household workers	6.1	6.1	6.5	7.7
Occupation not reported	<u>0.7</u>	<u>1.1</u>	<u>4.6</u>	<u>5.9</u>
Total <u>a/</u>	100.0	100.0	100.0	100.0

a/ Rounded to 100.0 percent.

Sources: U.S. Bureau of the Census, Census of Population, 1970, General Social and Economic Characteristics, U.S. Summary, Final Report PC(1)-C1, Washington, D.C., U.S. Government Printing Office.

U.S. Bureau of the Census, Census of Population, 1950, Characteristics of the Population, U.S. Summary, Vol. II, Pt. 1, Washington, D.C., U.S. Government Printing Office.

Table 2

OCCUPATIONAL DISTRIBUTION OF ENLISTED POSITIONS,  
SELECTED YEARS 1945-1967

<u>Occupation Group</u>	<u>Percent Distribution</u>			
	<u>1945</u>	<u>1953</u>	<u>1963</u>	<u>1967</u>
Ground Combat	24.1	17.3	14.1	14.1
Electronics	5.8	9.5	14.2	14.7
Other Technical	7.2	7.3	8.1	7.7
Administrative and clerical	15.3	20.6	19.9	18.4
Mechanics and Repairmen	20.0	22.3	24.5	26.1
Craftsmen	9.2	6.6	7.2	6.8
Services	16.6	15.4	11.9	12.0
Miscellaneous	<u>1.9</u>	<u>--</u>	<u>--</u>	<u>--</u>
Total <u>a/</u>	100.0	100.0	100.0	100.0

a/ Rounded to 100.0 percent.

Sources: Harold Wool, The Military Specialist: Skilled Manpower for the Armed Forces, Baltimore, The Johns Hopkins Press, 1969, and U.S. Bureau of the Census, Statistical Abstract of the United States, Washington, D.C., U.S. Government Printing Office, 1970 edition.

classification systems, respectively.<sup>1</sup>

As can be seen from Table 2, during the post-World War II period, the occupational distribution of the military sector has changed considerably. The ground combat and services occupations have diminished in importance while the electronic and mechanics and repairmen occupations have gained in importance. Of some interest, the proportion of enlisted personnel in ground combat positions did not rise during the Vietnam War, suggesting that this proportion may have fallen as a result of recent reductions in military strength.

Although it is clear that since World War II similar changes have occurred in the occupational structure of the civilian and military sectors, a number of difficulties in comparing the Census and DOD data should be mentioned. An obvious difficulty is that there is little overlap in the titles of the major occupation groupings. The absence of farmers and farm managers from Table 2, for example, is hardly surprising. But one notices that professional and managerial workers are also missing from this table. Some workers who are classified as professionals by the Census, such as photographers and accountants, are classified as "other technical" and "administrative and clerical workers," respectively, by the DOD. More importantly, Table 2 is restricted to enlisted positions and hence excludes officers.<sup>2</sup> Since approximately 15 percent of all military personnel are officers

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<sup>1</sup>The data for the military in Table 2 refer to authorized enlisted personnel strength rather than the actual personnel in each occupational group. As indicated in [16, p. 193], differences between authorized and actual strength have been small.

<sup>2</sup>The distinction between officers and enlisted personnel is particularly important in analyzing manpower policies pertaining to the professional and managerial occupations. It also poses the question of optimal promotional paths in an all-volunteer military establishment. It may be, for example, that military service would be more attractive to young persons if the probability of promotion from the enlisted to officer ranks were higher than it is now.

[6, p. 25], comparison of the occupational distribution of enlisted personnel and civilian workers omits a not insubstantial segment of the work force in the military sector.<sup>3</sup>

Other groups missing from Table 2 are the sales, operative and laborer occupations. Although some military personnel are employed in sales occupations, e.g., commissary workers, the counterpart of the civilian sales worker is almost absent in the military. Less obvious is the fact that only a small number of detailed occupations in the military correspond to the operative and laborer occupations. Most operatives and many laborers are employed in manufacturing, an activity which is almost wholly restricted to the civilian sector.<sup>4</sup>

The foregoing suggests that in a number of occupation areas there is little direct competition between the civilian and military sectors. This is not to say that competition is lacking, rather it is indirect in that individuals may choose between jobs and careers which are largely unique to the military, e.g., ground combat, or largely unique to the civilian sector, notably in laborer, operative and sales occupations. There are a large number of occupations, however, where competition

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<sup>3</sup>The DOD classifies officers into eight occupational groups: general officers and executives, tactical operations officers, intelligence officers, engineering and maintenance officers, scientists and professionals, medical officers, administrators, and supply procurement and allied officers [5, pp. 1-5]. The second group includes pilots and aircraft crews and is similar to the ground combat component for the enlisted force. The next four groups are primarily professional workers. The remaining groups comprise the managerial class.

<sup>4</sup>It is interesting to note, however, that in 1970 approximately one-quarter of all operatives were drivers of automobiles, buses and trucks, a skill which is of some importance in the ground combat specialties. This serves to illustrate an essential difference between civilian and military occupations, i.e., even where occupational titles are the same, the military job often requires skills, e.g., the skill of maintaining and shooting a rifle, which is primarily military in nature.

between the civilian and military sectors is direct, i.e., where occupation skills overlap both sectors. This is true of the administrative and clerical as well as the service occupations, but is of particular importance for the craftsmen and related occupations<sup>5</sup> where shortfalls in the military sector are most likely to occur.<sup>6</sup>

In Table 3, the craftsmen and related occupations are separated into three categories: electronics technicians, mechanics and repairmen, and craftsmen (excluding mechanics and repairmen). Included among electronics technicians are radio operators who in the civilian sector are classified by the Census as professional workers. Likewise, included among craftsmen (excluding mechanics and repairmen) are some workers, principally in the construction industry, who are classified as operatives and managers by the Census.<sup>7</sup>

A number of interesting inferences can be drawn from this table. The craftsmen and related occupations now comprise almost one-half of all enlisted positions (and approximately 40 percent of the entire military work force including officers). In the civilian sector, about one-fifth of the experienced male civilian work force<sup>8</sup> are in these occupations. Hence, although the experienced male civilian labor force

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<sup>5</sup>In the civilian sector, mechanics and repairmen are classified together with other craftsmen. For the discussion that follows, it is useful to distinguish mechanics and repairmen from other craftsmen as is done in the DOD classification.

<sup>6</sup>The measurement of manpower shortages and surpluses in military occupations is an important but difficult problem. It suffices to remark here that quantitative estimates of imbalances are sensitive to how specific skills are grouped into detailed occupations.

<sup>7</sup>Civilian occupations corresponding to military groupings shown in Table 3 are found in [16].

<sup>8</sup>The experienced labor force includes the employed, unemployed, and persons who have worked at any time in the past.

Table 3

ANNUAL RATE OF GROWTH IN CRAFTSMEN AND RELATED OCCUPATIONS:  
MILITARY POSITIONS, 1953-1967, AND MALE EXPERIENCED  
CIVILIAN LABOR FORCE, 1950-1970

	<u>Enlisted Positions a/</u>		<u>Experienced Male Civilian Labor Force a/</u>		<u>Annual Rate of Growth</u>	
	<u>1953</u>	<u>1967</u>	<u>1950</u>	<u>1970</u>	<u>Enlisted Positions</u>	<u>Exp. Civ. Male Labor Force</u>
Craftsmen and related occupations	872	1,130	8,423	11,503	1.9	1.6
Electronics technicians <u>b/</u>	216	<del>344</del> 349	107	307	3.5	5.4
Mechanics and repairs <u>c/</u>	506	619	1,646	2,196	1.5	1.5
Aircraft	172	236	73	144	2.3	3.5
Automotive	82	106	667	928	1.9	1.7
Other	252	277	906 <sup>b/</sup>	1,124 <sup>b/</sup>	0.7	1.1
Craftsmen (excluding electronics technicians and mechanics and repairmen)	150	162	7,037	9,000	0.6	1.2
Construction and utilities <u>d/ e/</u>	51	62	3,163	3,526	1.4	0.5
Shipboard operations <u>f/</u>	36	34	59	30	-0.4	-3.3
Metal working <u>g/</u>	24	23	1,008	1,103	-0.3	0.5
Other	39	43	2,807	4,341	0.7	2.2
All other occupations <u>h/</u>	1,394	1,245	34,299	37,909	-0.8	0.5
Total	2,266	2,375	42,722	49,412	0.3	0.7

a/ Number in thousands.

b/ Includes radio and television mechanics.

c/ Excludes air conditioning, heat and refrigeration mechanics, and radio and television mechanics.

d/ Includes stationary firemen, power station operators, construction managers and construction apprentices.

e/ Includes air conditioning and heat and refrigeration mechanics.

f/ Includes sailors, and deckhands and boatmen.

g/ Includes welders and flamecutters, and metalworking apprentices.

h/ Excludes occupations cited in footnotes d, f, and g.

Source: See sources cited in Tables 1 and 2.

is more than 20 times as large as the enlisted military work force, the number of civilian craftsmen is only 10 times as large as the number of craftsmen in the military. Additionally, more than one-half of the craftsmen in the military are concentrated in mechanics and repairmen occupations. In these occupations, the ratio of civilian to military workers is only 3.5 to 1. Thus for this important group of occupations, labor market conditions in the civilian economy will have important implications for manpower management in the military sector and, conversely, manpower policies in the latter sector can have an important impact on the former sector. For example, in a draft environment, much of the training provided by the military will be lost when draftees return to civilian life and embark on careers of their own choice. In an all-volunteer military establishment where individuals are much more likely to receive the type of training they desire, there is a correspondingly greater likelihood that if they choose a career in the civilian sector, it will be in a field related to their military training.<sup>9</sup>

The data in Table 3 indicate that for some occupational groups the ratio of civilian male workers to military workers is high, e.g., in construction and utilities and the metal working trades. Where this is so, the possibilities for lateral transfer between the civilian and military sectors may be good. Where the ratio is low, however, the pool of manpower in the civilian sector available for work in the military is likely to be small and lateral transfer may be difficult to effect. It is of some interest, therefore, to note that for the electronics and aircraft mechanics and repairmen occupations, which comprise more than one-half of the positions in craftsmen and related skills in the military, the ratio of civilian to military workers is very low.

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<sup>9</sup>This suggests that earlier studies of transference of skills [15] and assessments of the extent to which military training is specific or general training may not be relevant in the context of a no-draft environment. If transference of skills does occur, the social and private returns on investment in human capital, represented by training in craft trades and other skill areas, could be large.

Lateral transfer may be difficult to effect for another reason despite its apparent attractiveness to the military. The cost of training to the military can be quite high, as much as \$15,000 in some specialties, but more typically \$10,000 - \$12,000 (see [7]). If this amount is amortized over a four year period, \$2,500 - \$3,000 per year could be offered as a premium to workers trained in the civilian sector who accept a temporary job assignment in the military. Lateral transfer is not without its costs to the individual, however. Besides the possibility of some unemployment when the military contract period ends, there is the possibility of foregone promotion opportunities, lost seniority and pension rights, and the psychic costs of changing jobs, particularly if a change in location is required. These costs can be large. For example, Galloway [8, 35-39] estimates that the cost of changing from a job in New England to one on the Pacific Coast, most of which is unrelated to the expense of moving family possessions, ranges from \$3,000 to \$4,000 per year over a five year time horizon. The point to be emphasized here is that in evaluating lateral transfer as a means for increasing the supply of manpower to the military, both costs and benefits need to be taken into consideration.

In addition to the limited supply of civilian manpower in the craftsmen and related occupations relative to the needs of the military, the growth of these occupations in the civilian sector has been very rapid. During the period since World War II, the rate of growth of civilian craftsmen and related occupations has been 1.6 percent per year compared to 0.5 percent per year for the rest of the civilian work force.<sup>10</sup> To illustrate the cumulative effect of this difference in growth rates, \$100 compounded annually at a rate of 1.6 percent will grow to \$200 in 44 years. Compounded at an annual rate of 0.5 percent, it would take

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<sup>10</sup> Annual rates of growth are shown since the data in each sector cover different periods of time. The annual rate of growth is computed by solving for  $r$  in the relationship  $Y = A(1+r)^t$  where  $A$  and  $Y$  are the number of individuals in an occupation at the initial and terminal dates, respectively, and  $t$  is the number of years between the two dates.



139 years to double. It should be noted, moreover, that the most rapidly growing craftsmen occupations in the civilian sector -- electronics technicians and aircraft mechanics and repairmen -- are also the occupations for which the demand for manpower has risen most in the military. Hence, it is not surprising that the military has experienced difficulty in meeting its needs for personnel in these technical fields. Granting that the drawdown from the peak strength of the Vietnam War will improve the short-run military manpower balance sheet, should these trends continue, they portend serious problems for the all-volunteer force which are now somewhat obscured by the emphasis on procurement of combat arms personnel.

The reasons for the more rapid growth of male employment in the craftsmen and related occupations than in all other occupations are many and an extended discussion at this point would be unwarranted. A few brief observations, although tangential to the main discussion, are of interest. First, the technology of production has become increasingly complex over time. Second, as the consumption of leisure has increased and the structure of the economy has changed, female labor force participation has increased in occupations where they have a comparative advantage, namely, the professional, clerical, and sales occupations. This comparative advantage results from the nature of the training required, i.e., formal education which has been financed by the community or individual and the ease in which part-time employment can be obtained in these fields. For this reason, the recent growth of female employment in professional jobs outside the traditional fields of teaching and nursing may be expected to continue for the foreseeable future. It is therefore likely that the diminishing supply of male labor will continue to be funneled into the craftsmen and related occupations where, because of the increasing complexity of technology, demand is growing, and where males have a comparative advantage, again because of training requirements, in this case, on-the-job training, and the difficulty of part-time work in production oriented jobs.

As shown in Table 1, 19.7 percent of all males were employed in craftsmen and kindred jobs in 1970. In contrast, only 1.7 percent of

all females were employed in such jobs. Thus the large proportion that these jobs comprise of all jobs in the military constraints the amount of direct substitution possible between women and men. Employment of women is possible in other occupations, however, which could free men in the military from, say, clerical jobs, for employment in craftsmen jobs. But the proportion of non-craftsmen jobs that could be filled by women would be smaller than in the civilian sector since many of these jobs are in combat units. Additionally, of importance from an institutional standpoint, in the military women are now permanently terminated from service (except where a waiver is granted) when they bear children. Even if this were not the case, the general tendency for women to withdraw from the labor force to raise a family places a barrier on their embarking on a career in any occupation in the military. Since most enlisted personnel retire after twenty years of service, women who re-enter the labor market after family responsibilities diminish could not look forward to an extended period of reemployment in the military. For these reasons, increased utilization of women can be expected to have only a marginal impact in resolving the manpower problems currently facing the all-volunteer army.

The trends noted raise another important issue for long-run manpower policy, namely, whether the military should attempt to maximize initial enlistments or reenlistments.<sup>11</sup> At least two arguments can be offered for the latter policy. First, the recent decline in the birth rate will make future recruitment of new entrants into the military sector more difficult (see [14]). Second, a military establishment

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<sup>11</sup>In one sense, the two options are compatible in that the larger the number of initial enlistments, the larger the number of reenlistments, all other things remaining equal. In another sense, they are not. The rapid rise in the cost of military manpower, from 42 to 56 percent of the military budget between 1968 and 1974 [2], suggests that in the future it may be necessary to choose between making initial or career service more attractive, but not both. Recent discussions in Congress concerning the burgeoning costs of military pensions are one indication that this choice may not be far off.

comprised of a large proportion of career personnel would reduce the cost of training an all-volunteer force. But as indicated above, the demand for personnel with craftsmen skills by the military is large relative to the total demand for such services, and civilian craftsmen and related occupations have been growing more rapidly than other occupations,<sup>12</sup> particularly in the technical skill areas. Hence, the marginal cost to the military of attracting additional career personnel could be substantially higher than the average cost, particularly if the mechanism used to obtain personnel is across-the-board pay raises versus selective pay raises or bonuses.

Although much attention has been given to the wage elasticity of volunteers, there is some indication that the opportunity to learn a skill or trade is at least as important an inducement to enlist as is military pay (see [11]). This suggests the policy of utilizing the military as a vehicle for training a large number of young people for employment in areas where shortages are being experienced in the civilian sector as an alternative to relying on reenlistments as the major source of military manpower. This policy could provide a means for offsetting the potential decline in manpower availability by increasing the propensity of those who are available to enlist for military service. It would also reduce the possibility of spiraling wage rates which could result from both sectors competing for the same body of workers to fill career positions. By providing initial training to inexperienced workers rather than attempting to maximize reenlistments,<sup>13</sup> such competition would be reduced and retention costs lowered.

<sup>12</sup>The same is also true for professional, technical and kindred workers. During the period 1950-70, the annual rate of increase of male experienced workers in this occupation group was 4.2 percent.

<sup>13</sup>Much beyond the scope of this discussion is the problem of computing potential costs and benefits to the military of enlisting, say, five individuals for a duration of four years each versus one individual for a term of 20 years to retirement. This exercise is not an easy one to perform (see [4]). As in the case of lateral transfer, estimation of numerical magnitudes could provide useful insights.

The policy of using the military to provide on-the-job training for young people as a means of satisfying the manpower requirements of a volunteer military establishment is similar in some respects to Project 100,000 except that the emphasis is directed not so much at providing training to individuals who otherwise would have difficulty in competing in the labor market as to individuals who can compete and who would normally opt for on-the-job training in the civilian sector. This policy would involve substantial costs to the military in that the costs of training, including subsidies to induce individuals to accept training in the military, would be carried in the defense budget. As an offset, however, this approach could ease the problem of maintaining a trained reserve to meet contingency situations, not to mention the substantial social and economic benefits that might be realized.

The problem of obtaining manpower for the U.S. Navy may be particularly acute since its requirement for workers in the craftsmen and related occupations are markedly higher than for the other services. As can be seen from Table 4, in 1963 (the latest date for which such information is available) enlisted positions in these occupations comprised 75.2 percent for the Navy, 50.6 percent for the Air Force, and 29.3 and 31.8 percent, respectively, for the Army and Marine Corps. The higher percentage of Navy positions in the craftsmen and related occupations vis-a-vis the Army and Marine Corps is not surprising since these services are the only ones with ground combat forces. The half again as large percentage for the Navy as compared to the Air Force is, however, somewhat unexpected and is explainable by the unique environment of the Navy. First, ships are immensely more complicated than aircraft, thereby requiring a higher ratio of technical skill to support personnel and, second, ships, in contrast to aircraft, are self-contained units which need to be habitated on a continual basis, thereby constraining specialization of supporting functions such as clerical and service work. Thus, the Navy will find it more difficult to meet its manpower needs than the other services, if only because its demand for craftsmen and kindred personnel is much larger.

Table 4

OCCUPATIONAL DISTRIBUTION OF ENLISTED POSITIONS  
BY SERVICE, 1963

<u>Occupation Group</u>	<u>Percent Distribution</u>			
	<u>Army</u>	<u>Marine Corps</u>	<u>Navy</u>	<u>Air Force</u>
Ground Combat	28.8	40.5	-	-
Electronics <u>a/</u>	9.1	11.5	22.3	15.8
Other Technical	8.6	3.1	8.0	8.5
Administrative and Clerical	18.6	18.1	9.5	28.2
Mechanics and Repairmen <u>a/</u>	16.5	15.5	41.2	25.4
Craftsmen <u>a/</u>	3.7	1.8	11.7	9.4
Services	<u>14.5</u>	<u>9.3</u>	<u>7.2</u>	<u>12.6</u>
Total <u>b/</u>	100.0	100.0	100.0	100.0

a/ Craftsmen and related occupations.

b/ Rounded to 100.0 percent.

Source: Harold Wool, The Military Specialist: Skilled Manpower for the Armed Forces, (Baltimore: The Johns Hopkins Press, 1969).

The requirement for operating at sea may make it more difficult also for the Navy to recruit and retain personnel than for the other services. Evidence in support of this view is scanty but what little there is is consistent with it. For example, in the few studies in which the wage elasticity of supply, i.e., the percentage change in the first-term enlistment rate when the military/civilian wage increases by one percent, has been estimated for the individual services, the wage elasticity has been found to be lower for the Navy than for the Air Force and Army (see [1] [3] [10]). It appears also that the Navy does not fare as well as the Air Force with respect to retention. As can be seen from Table 5,<sup>14</sup> during fiscal year 1972, reenlistment rates were lower for the Navy than for the Air Force in almost all occupational groups.<sup>15</sup> In only two, electronics equipment repairmen and service and supply handlers, was the retention rate substantially higher for the Navy. The very high reenlistment rate among Navy electronics and equipment repairmen may be due to the high proportion of enlistees in this occupation who extend their period of enlistment for an extra two years to receive advanced training, e.g., as in the nuclear field. Such individuals are counted as having reenlisted even though they often leave the Navy after six years of service.

As a final note, on the basis of the foregoing analysis, one would expect that reenlistment rates in the craftsmen and related occupations are lower than in other occupations due to differential employment opportunities in the civilian sector. Some evidence that this is the case is seen from Table 5. In all services except the Navy, the

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<sup>14</sup>Note should be made that the DOD classification in this table is somewhat different from the one in Wool [16].

<sup>15</sup>Individuals in the Navy and Air Force making a reenlistment decision during fiscal year 1972 enlisted for a minimum of four years. The minimum enlistment length for the other services is two years. Since length of enlistment is a very important factor influencing the reenlistment decision [13], for the context at hand, comparison of the Navy and Air Force reenlistment rates with those of the other services is not possible.

Table 5

REENLISTMENT RATES BY OCCUPATIONAL GROUP AND SERVICE,  
FISCAL YEAR 1972 <sup>a/</sup>

<u>Occupation Group</u>	<u>Army</u>	<u>Marine Corps</u>	<u>Navy</u>	<u>Air Force</u>
Craftsmen and related occupations: <sup>b/</sup>	15.1	22.4	43.7	57.3
Electronics and equipment repairmen	16.7	23.3	62.4	59.8
Communications and intelligence specialists	17.0	21.5	33.3	54.1
Electrical, mechanical equipment repairmen	14.3	22.6	38.9	57.5
Craftsmen	12.3	21.7	34.1	55.6
Other occupations: <sup>b/</sup>	22.7	22.8	42.6	60.1
Infantry, gun crew and allied specialists	27.7	18.3	35.3	92.9
Medical and dental specialists	22.1	- <sup>c/</sup>	39.6	54.7
Other technical and allied specialists	12.9	31.5	41.6	62.4
Administrative specialists and clerks	19.9	32.5	42.0	64.5
Service and supply handlers	23.1	16.8	58.5	50.2
Miscellaneous	20.6	-	11.7	63.1
All occupations	19.8	22.9	43.4	58.7

<sup>a/</sup> The percentage of individuals eligible to reenlist during fiscal year 1972 who reenlisted or extended their period of enlistment for two or more years.

<sup>b/</sup> Weighted averages.

<sup>c/</sup> Less than 500 individuals eligible for reenlistment.

Source: Department of Defense, Selected Manpower Statistics, Directorate for Information Operations, April 15, 1973.

reenlistment rate is less for the craftsmen and related occupations despite the prevalence of special monetary inducements to encourage reenlistment which are offered to enlistees in specialized skill areas, e.g., electronics equipment and repairmen, but not in other occupations, e.g., service and supply handlers (see [12]).

### Conclusion

In this paper, the occupational structure of the civilian and military work force is examined, and some implications are drawn pertaining to military manpower policies in an all-volunteer environment. Some implications for the Navy are explored also with reference to the Navy's competitive position vis-a-vis the other services.

The occupation data reveal that over time the less skilled components of the military work force have been declining, paralleling changes in the composition of the civilian labor force. While this has been known for some time, it is less well recognized that employment in the craftsmen and related skills in the military comprises a substantial proportion of total employment in these skills in the economy at large. Moreover, male employment in the craftsmen and related occupations in the civilian sector has been growing at a substantially faster rate than total male employment. These trends suggest that the civilian and military sectors are competing for the limited supply of male workers, and hence raises important questions for manpower policy. Perhaps the most crucial issue is whether the military should meet its manpower needs through increased retention or through training programs aimed at attracting new entrants. Both policies are likely to have a high price tag. The latter policy has the virtue of providing a pool of trained, skilled manpower to the civilian sector and the potential for meeting military reserve requirements. The occupational data also suggest that although the benefit to the military of lateral transfer from the civilian sector is high, the possibilities of lateral transfer may be limited, since in those occupations where manpower shortages are most likely to occur, the ratio of civilian to military employment is very low. Likewise, the occupational structure of the military and nature



of employment in this sector may limit the extent to which female labor services can be utilized.

Given the constraint that occupational structure places on policies designed to increase the supply of military manpower, such as lateral transfer and the utilization of female labor services, the question arises as to the options that are most likely to succeed in solving the long-run manpower needs of an all-volunteer force. One obvious way to correct labor market imbalances is to increase compensation in occupations where a shortage of personnel exists. As noted, this may be costly if pay increases are directed toward increasing retention. An alternative approach would focus on first-term enlistees and emphasize the non-compensation inducement training. The thrust of these approaches is to increase the supply of skilled manpower to the military. Adjustments can be made also on the demand side. When the price of a factor input rises, or a shortage manifests itself because the price of factor is sticky, as is the case in military labor markets where market forces operate imperfectly, output levels can be maintained most efficiently by substituting other factors for the given factor. Where the given factor is skilled labor, this generally means substituting capital for labor to reduce the requirement of labor at all skill levels. Capital substitution has been taking place in the military increasing output, e.g., firepower, per unit of labor input. The occupational data reviewed in this paper suggest, however, that the capital that has been developed has reduced the requirement for unskilled personnel but at the same time has increased the requirement for more skilled personnel (see Table 3). Thus, in the future, emphasis needs to be given to changes in technology which lead to the substitution of less skilled labor for more skilled labor and reduces the requirement for the latter in absolute terms.

Notwithstanding the recent attention that has been focused on the difficulty of meeting ground combat personnel requirements in the Army, this study suggests that in the near future, each of the services may have even greater difficulty in meeting requirements for skilled personnel in craftsmen and related occupations. This problem may be

particularly severe for the Navy because of all the services, the proportion of its work force in these occupations is by far the largest. The ability of the Navy to retain, and perhaps attract, personnel is also hampered by the environment in which it operates. In nearly all occupational groups, Navy retention rates are lower than for its closest competitor, the Air Force. Hence, adjustments in pay structure, substitution of capital for labor, and changes in technology which permit the substitution of less skilled personnel for more skilled personnel, are of particular relevance for the Navy if it is to bring its manpower needs into equilibrium with the supply of manpower that is available to it.<sup>16</sup> In the long run, these approaches may be more important than lateral transfer and the utilization of women in making the all-volunteer force a viable institution.

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<sup>16</sup>The development of automated ships is an example of a technological change which can lead to a reduced demand for skilled manpower. The Air Force also appears to be giving serious consideration, and perhaps the other services as well, to capital equipment which employs less skilled labor input, e.g., the use of unmanned, expendable drones instead of manned aircraft (see [9]).

## REFERENCES

- [1] Stuart H. Altman, "Earnings, Unemployment and the Supply of Enlisted Volunteers," Journal of Human Resources, IV-1, 1969, 38-59.
- [2] Luther J. Carter, et al., "Fiscal 1974 Budget," Science, 179,  
9 February 1973, 550-1.
- [3] Alvin A. Cook, Jr., "The Supply of Air Force Volunteers," The RAND Corporation, Santa Monica, California, 1970.
- [4] Department of Defense, Effect of Various Re-Enlistment Rates on the Composition and Cost of Air Force Enlisted Personnel, Study No. 19, Standards Evaluation Branch, Planning Research Division, 26 July 1950.
- [5] Department of Defense, Officer Occupational Conversion Table, Office of the Assistant Secretary of Defense, Manpower and Reserve Affairs, DA PAM 611-11, March 1972.
- [6] Department of Defense, Selected Manpower Statistics, OASD (Comptroller), Directorate for Information Operations, April 15, 1973.
- [7] Department of the Navy, Annual Training Time and Cost for Navy Ratings and NECs, Bureau of Naval Personnel, Nav Pers 18660, November 1962.
- [8] Lowell E. Gallaway, Geographic Labor Mobility in the United States, 1957 to 1960 (Washington, D. C.: Government Printing Office, 1969).
- [9] Robert Gillete, "Military R and D: Hard Lessons of an Electronic War," Science, 182,9 November 1973, 559-61.
- [10] Burton C. Gray, "Supply of First Term Enlistees," in The President's Commission on an All-Volunteer Force, The Report of the

Presidential Commission on an All-Volunteer Force, II-2-1-40,  
(Washington, D.C.: Government Printing Office, November, 1970).

- [11] Sheldon E. Haber, "Compensation and Non-Compensation Inducements and the Supply of Military Manpower," Proceedings of the 31st Meeting of the Military Operations Research Society, Washington, D. C., 1973 (forthcoming).
- [12] Sheldon E. Haber, "Some Aspects of Navy Manpower Management: Career Manning Ratios, Variable Reenlistment Bonuses and Proficiency Pay," The George Washington University, Graduate School of Arts and Sciences, Technical Report Serial TR-1146, 30 July 1973.
- [13] Sheldon E. Haber, T. Ireland and Herbert Solomon, "Manpower Policy and the Reenlistment Rate," The George Washington University, Graduate School of Arts and Sciences, Technical Report (forthcoming).
- [14] Charles T. Stewart, Jr., "Demographic Trends and Naval Manpower Policies," The George Washington University, Graduate School of Arts and Sciences, Technical Report Serial TR-1122, 8 June 1973.
- [15] Paul A. Weinstein and Eugene L. Jurkowitz, "The Military as a Trainer: A Study of Problems in Measuring Crossover," Proceedings of the 19th Annual Winter Meeting, Industrial Relations Research Association, San Francisco, California, December 28-29, 1966.
- [16] Harold Wool, The Military Specialist: Skilled Manpower for the Armed Forces, Baltimore, The Johns Hopkins Press, 1969.

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